

**Radio Shack**

Color Computer

32K Required

Cat. No. 26-3108

# FLIGHTSIM I



RADIO SHACK, A DIVISION OF TANDY CORPORATION

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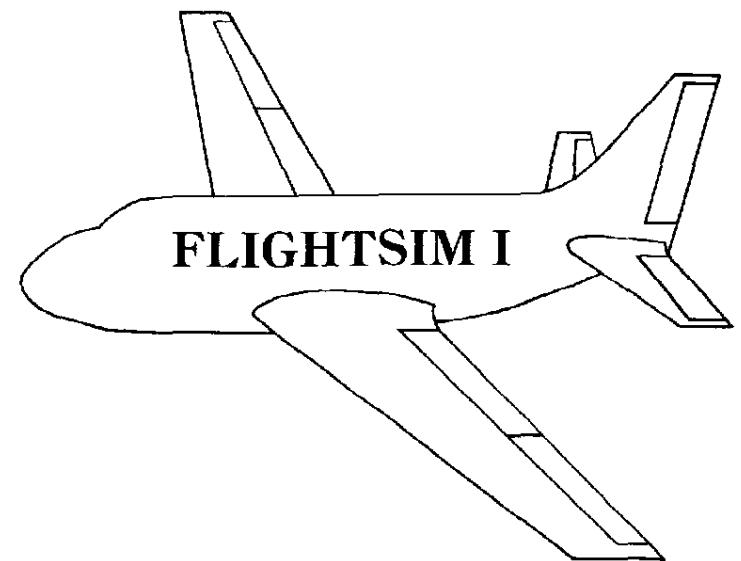
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*Manual written by Jonathan Mendoza*

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## Introduction

**Flight Simulator I (FLIGHTSIM I)** puts you inside the cockpit, behind the controls of a high performance jet. If you have ever entertained notions about flying, you'll find this Disk Program for your Color Computer both stimulating and challenging.

The simulation environment consists of approximately 22,185 square miles and recreates most of the conditions normally encountered in actual flight. You can fly your jet to any of eight airports or nine landmarks scattered throughout the simulation area.

The Jet features retractable gear, full flap control, and a cruising speed of 375 knots (or 432 mph). Its instrument panel includes Auto-Pilot, Glidescope, Attitude Deviation Indicator (ADI), Altitude, Speed, Rate of Climb indicators, and various other monitoring devices.

Although you may wish to take off immediately, it is a good idea to examine the laws and principles that make flight possible. The first section of the manual, "Ground School," offers a brief introduction of these concepts. If you already know some flight theory and want to "fly" immediately, skim over the first section and then go directly to "Aboard the Jet," where you become acquainted with the various controls and indicators and their respective functions. Finally, the "Sample Session" coaches you through some elementary flight procedures (such as taking off and landing). After experimenting with

your controls and attempting some maneuvers, use the aeronautical map included to devise a "flight plan," a methodical way to reach a particular destination.

When you become adept at flying the jet, you are certainly not a qualified pilot. However, you will have gained a basic understanding of aerodynamics and the mechanics of flight. Who knows, someday you may face a real runway.

## Required Equipment

To use FLIGHTSIM I, you need the following equipment:

- A Color Computer with 32K Memory (RAM)
- A TV monitor
- A Color Computer Mini Disk®
- Two joysticks (self-centering Deluxe Joysticks,® 26-3012, recommended)

## Ground School

A complete understanding of flight involves delving into the fields of meteorology, physics, aerodynamics, and a variety of related disciplines. To undertake such a study requires considerable time and vast quantities of information that cannot be supplied here. The purpose of this section, however, is to acquaint you with some of the basic principles that make flight of heavier-than-air craft possible. (If you wish to pursue flight theory further, visit your public library.)

## Theory of Flight

There is no mystery to flight. Flight is simply the result of harnessing some known natural forces. In its simplest form, flight takes advantage of two particular laws of nature:

- Areas of high pressure tend to move into areas of low pressure. (This is the same law that allows meteorologists to predict the weather.)
- When a gas (such as the air that surrounds us) is accelerated, it loses pressure. This law is known as the Bernoulli Principle.

But how does an airplane that may weigh several thousand pounds use these laws to launch itself into the air and climb to great altitudes? The secret, as you will see, is in the interaction between the wind and the wing. But before examining this interaction, let's take a closer look at the two laws that make flight a reality.

## High and Low Pressure Areas

Our planet is enveloped in a shroud of air that we call the atmosphere. The atmosphere is never static. A combination of atmospheric factors — such as temperature, density, humidity, and so on — produces high and low pressure areas. High and low pressure areas can be, and often are, immense. Anybody who watches the weather on TV has seen meteorological charts with the high and low pressure areas prominently displayed.

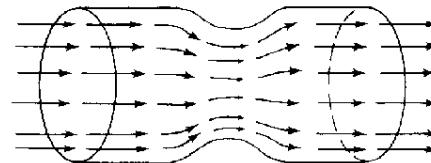
Meteorologists have discovered that much of the weather we experience is a direct result of high pressure areas pushing their way into low pressure areas, as the law above maintains. Thus, huge masses of air move and shift, bringing with them warm or cold fronts and even disastrous weather.

Aeronautical engineers have also studied this law. They have learned how to apply it to produce the wonder of air travel. An airplane flies by creating a low pressure area above its wings while the air pressure below the wings remains high. The high pressure area (below), in its attempt to move into the low pressure area (above), pushes the wings in an upward direction. This is known as lift in aerodynamic terms. But how is the low pressure area above the wing created? A closer look at Bernoulli's Principle is the first step in answering this question.

## Bernoulli's Principle

In the 18th century, a Swiss scientist by the name of Bernoulli made a crucial discovery — when the speed of a fluid or gas increases, its pressure decreases. Today's sophisticated aircraft, which can soar thousands of feet over the ground and cover vast expanses of territory, continue to rely on this seemingly simple principle.

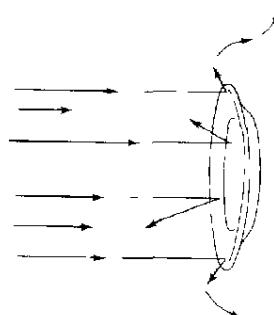
Bernoulli's principle can be demonstrated by rushing air through a venturi tube. A venturi tube is a tube-like device with a narrow middle portion and wider ends. Air is rushed into the tube at a fixed rate. As the air reaches the narrow section of the tube, it speeds up and loses pressure. Leaving the narrow area, the air slows down and regains pressure. Pressure loss occurs because the air molecules exert energy as they are forced to accelerate through the narrow portion. This acceleration leaves the air molecules with less energy for producing pressure.



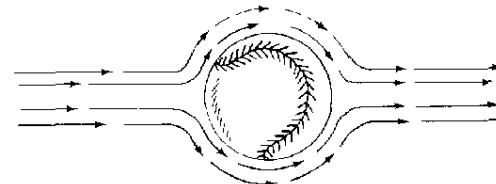
## The Wind and the Wing

As was mentioned at the beginning, the interaction between the wind and the wing is responsible for the phenomenon of flight. The wing is a specially designed structure that controls the flow of air above and below its surface in a precise manner. The wing of any airplane causes the air above its surface to accelerate and thus lose pressure (Bernoulli's Principle). The air below the wing does not accelerate as much and, therefore, retains higher pressure. To understand how the wing controls the flow of air in this way, consider first how other objects interact with the wind.

Suppose that you are driving a car at a moderate speed. Next to you, on the seat, are a dinner plate and a baseball. First, you take the plate and stick it out of the window with its circular surface facing the wind directly. Immediately, you feel your arm pushed back. The plate blocks oncoming air and opposes the smooth flow of wind around it. The wind tends to offer resistance to the movement of any object. This is known as **drag** in aerodynamic terms. The plate, facing the wind directly, is creating maximum drag. (See the illustration.)



Now, you take the baseball and stick it out the window. You experience some drag, but not nearly as much as with the plate. The baseball has no flat surfaces. Instead, it presents a smooth, curved surface to the oncoming wind. The wind flow does not meet direct opposition. The air is able to curve above and below the baseball and continue its path. (See illustration.)



Finally, consider the wing. The wing, unlike the plate or the baseball, controls the flow of air above and below it in a precise way. To see how this is possible, examine a cross section of a wing.



The leading edge of the wing presents a curved surface to the oncoming air. The top (or top camber) of the wing is slightly rounded. The bottom camber is flatter.

As an airplane speeds down a runway, the wing causes oncoming air to split into two paths — over the top camber and below the bottom camber. The streams of air meet again at the trailing edge of the wing. The air on top of the wing, however, travels a

longer distance since the top camber forces the air to curve around it. The air below the wing, by comparison, travels a straighter path and a shorter distance. Yet, the air below and above meet exactly at the same time at the trailing edge of the wing. The only way this can happen is because the air above the wing accelerates.

As Bernoulli's Principle maintains, the air over the wing has to lose pressure, because it is being accelerated by the shape of the wing. When the pressure differential between the air above and below the wing is sufficient, lift is created. This is a confirmation of the fact that high pressure areas move into low pressure areas.

### **The Four Forces (lift, gravity, thrust, and drag)**

There are four unseen forces to which any airplane in straight and level flight is subjected. Two of these forces have already been mentioned — lift and drag. The other two forces are gravity and thrust. Lift and gravity are two forces that oppose each other directly. Similarly, thrust and drag oppose each other. There are various factors affecting the proportion each of these forces exercises on an aircraft. For the purpose of this program, only a brief description of each of the four forces is necessary.

#### **Lift**

Lift is an upward acting force that results from the pressure differential between air above and below the

wing of an airplane. Lift opposes gravity (or weight), the downward acting force. When lift is greater than gravity, an airplane climbs higher. When gravity is greater than lift, an airplane descends. However, when lift and gravity equal each other, an airplane maintains level flight.

#### **Gravity**

Gravity is the downward acting force that results from the weight of the airplane. Before the craft can be airborne, lift must overcome gravity.

#### **Thrust**

Thrust is the forward motion that is obtained from the aircraft's propeller or jet engine. Thrust is essential for the flight of any winged aircraft. When an airplane flies straight and level at a constant speed, thrust and drag equal each other. An increase in thrust (or engine power) causes a corresponding increase in drag. After these two forces balance each other, the airplane resumes a higher constant speed.

#### **Drag**

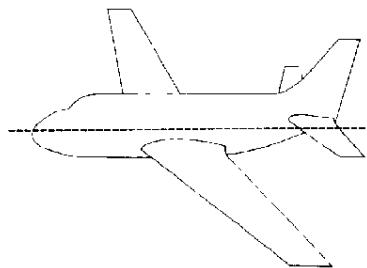
Drag is the opposition of the wind to any moving object. Drag can be reduced by streamlining the component parts of an airplane. Drag is desirable during certain maneuvers such as landing or decreasing air speed.

## The Three Axes

Unlike motion on a flat surface, motion in the air is three-dimensional. An airplane can climb or descend, turn right or left, and go forward. Any combination of these maneuvers requires the plane to gyrate around one (or more) of three axes which passes through the airplane's center of gravity.

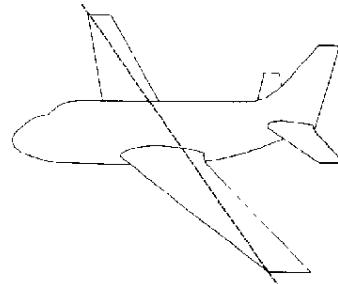
The airplane's path through the air and around its three axes is controlled by movable control surfaces on the wings and the tail. (These control surfaces are discussed later.) Consider each of the three axes separately.

### The Axis of Roll (or Longitudinal Axis)



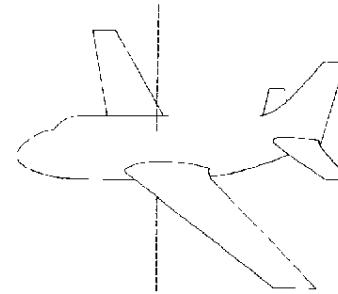
The axis of roll extends lengthwise through the nose and tail of the airplane. When other conditions remain equal and the left wing rolls up while the right wing rolls down, or vice versa, the airplane is rolling around the axis of roll. When an airplane rolls on this axis, it is said to be banking. Banking is associated with turning maneuvers.

### The Axis of Pitch (or Lateral Axis)



The axis of pitch stretches from wingtip to wingtip. When other conditions remain equal and the airplane's nose swings up while the tail goes down, and vice versa, the airplane is rolling around the axis of pitch. Movement around the axis of pitch is associated with climbing and descending maneuvers.

### The Axis of Yaw (or Vertical Axis)

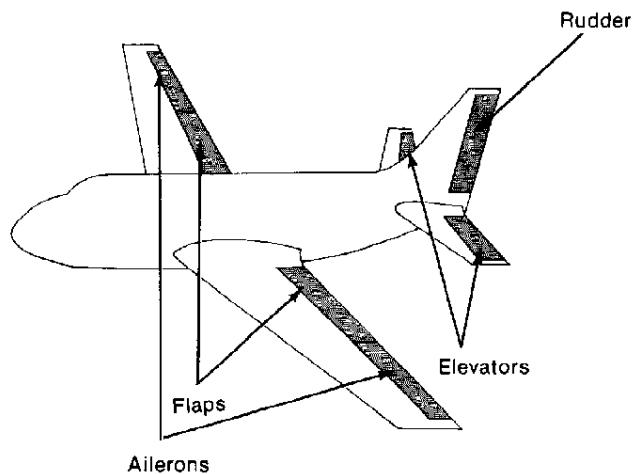


The axis of yaw is perpendicular to the other two and to the Earth's surface when the plane is flying in

straight and level flight. When other conditions remain equal and the wings swing left or right, the airplane is rolling around the axis of yaw. Movement around this axis is also associated with turning and banking maneuvers.

## The Control Surfaces

To accomplish every possible maneuver, whether climbing, descending, or turning, your airplane relies on certain control surfaces located on its wings and tail. The control surfaces on your jet, as in most airplanes, consist of the ailerons, the flaps, the rudder, and the elevators.



In FLIGHTSIM I, the action of these surfaces (except for the flaps) is controlled by the control column — the RIGHT Joystick. The flaps are manipulated through the keyboard. The following descriptions explain how the surfaces respond to the controls.

## The Ailerons

The ailerons are located near the wingtips. The coordinated movement of the ailerons lets you turn your jet around the axis of roll. When the control column is moved either left or right, the ailerons go to work. If you move the control column toward the left, the aileron on the left wing raises from a flat position. At the same time, the aileron on the right wing lowers from a flat position.

The left wing (with its aileron raised) starts to lower. This is because the aileron is in reality a small wing shape that bends the wind in such a way that an area of low pressure is created below its surface while the air pressure on top stays high. The high area above the aileron pushes the wing down. Meanwhile, the right wing, with its aileron lowered, acts in an opposite fashion on the left wing. That is, the lowered aileron creates an even lower pressure area above the wing. This causes a greater lifting force that pushes the right wing upwards.

When the control column is pushed toward the right, the opposite condition results, so that the right wing lowers and the left wing raises.

## The Elevators

The elevators are two control surfaces located in the tail of the airplane. The elevators sit horizontally (like the wings) and allow for movement around the axis of pitch. The control column also manipulates the motion of the elevators. When you push forward

on the control column, you force the elevators into a downward position. In this position, the elevators create a low pressure area above their surface. This causes the tail end of the airplane to lift. Conversely, the nose end lowers. By pulling backwards on the control column, the elevators are forced into a raised position. The low pressure area is now below the elevators. This causes the tail end to lower, while the nose raises.

### **The Rudder**

The rudder is also located on the tail of the airplane. The rudder sits in a vertical position (perpendicular to the elevators), and it controls movement around the axis of yaw. In most airplanes, the rudder is controlled with the rudder pedals. Your jet, however, allows for rudder control with the control column. When you push the control column to the left, the rudder turns toward the left. A low pressure area is then created on the right side of the rudder. This results in the entire tail end swinging toward the right. When this happens, the airplane's nose heads toward the left. The opposite results occur when you push the control column toward the right.

### **The Flaps**

The flaps are also located on the wings, but they're closer to the fuselage (or main body of the airplane). The flaps are normally held inside the wing but can be extended to increase the total area of the wing. In FLIGHTSIM I, the flaps are controlled by the keyboard (more on this in the "Controls and Indicators" section). Flaps are used to increase lift or decrease airspeed. They do not affect the gyration of the plane.

Like ailerons, flaps can also be lowered. Unlike ailerons, flaps always move in the same direction. When the flaps are extended half way, they increase the total area of the wing. This is how extra lift is created. When fully extended (and lowered), however, they increase drag. This, in turn, reduces airspeed.

## Aboard the Jet

Now that you understand the basic forces that create flight, you are ready to board the jet. Once inside, get acquainted with the various controls and indicators. It's important that you understand the effect of the controls on the aircraft and learn to interpret instrument readings. There are certain "flight parameters" that result in optimum flying conditions. You must also become familiar with these.

In addition, FLIGHTSIM I operates under various modes that give you complete control of the simulation. You'll derive the most from this program if you know how to activate and use the different FLIGHTSIM I modes.

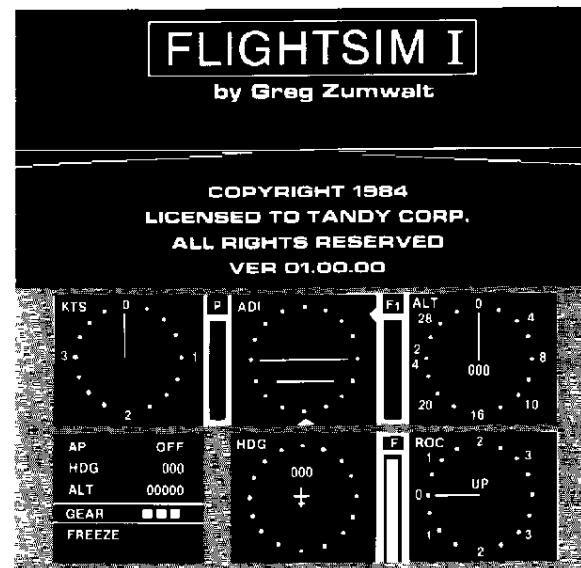
All the information you need to get the jet off the ground and into the air is contained in this section. However, for some quick step-by-step instructions on taking off and landing, see the "Sample Session."

## Loading Instructions

1. Before inserting the disk, be sure that the computer, TV, and disk drive are all turned on.
2. Insert the disk into the drive and lock the drive door.
3. Type LOADM "FLTSIM" and press **ENTER** at the OK prompt.
4. When the OK prompt returns to the screen, type EXEC **ENTER**.

## The Start-Up Screen

After loading and executing the program, your screen looks like this:



Notice that the screen is divided in half. The upper half of the screen is your view from the cockpit. At this point, the copyright message is on the window. Still, you can see the runway stretching out to the horizon. Later, when you're airborne, you'll be able to see the terrain and any airports or landmarks below.

The bottom half of the screen shows your instruments. All the dials and indicators may not make any sense now, but soon you'll be able to interpret their readings.

Notice the flashing word "FREEZE" on the Multi-Function indicator (at the bottom left corner of the screen). In the FREEZE mode, the simulation is "on hold" indefinitely — whether the airplane is sitting stationary on the ground (as it is now) or hundreds of feet in the air (as it will be shortly).

Before taking off, you need to familiarize yourself with the instruments in the jet.

## The Controls and Indicators

Your jet features a complete set of controls and indicators. Before you even attempt to take off, familiarize yourself with the controls, each of the instruments, and their functions.

Your two main controls consist of the throttle and the control column. These are the LEFT and RIGHT Joysticks respectively. In addition, you have several keyboard controls.

### Joystick Controls

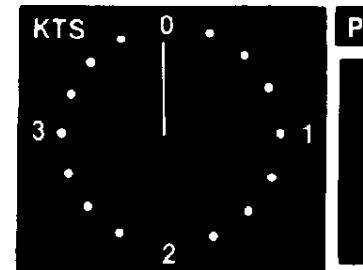
You will spend the majority of the time using the RIGHT and LEFT Joysticks to control and guide the jet. For this reason, let's examine the throttle and control column controls in more detail.

#### The Throttle Control

The throttle regulates the amount of fuel flowing into the engine. By pushing the LEFT Joystick

forward (full throttle) the engine develops maximum power. Pull back on the LEFT Joystick to decrease the amount of fuel and power.

There are two indicators on the screen directly related to the throttle control. These are the Airspeed and Power indicators.



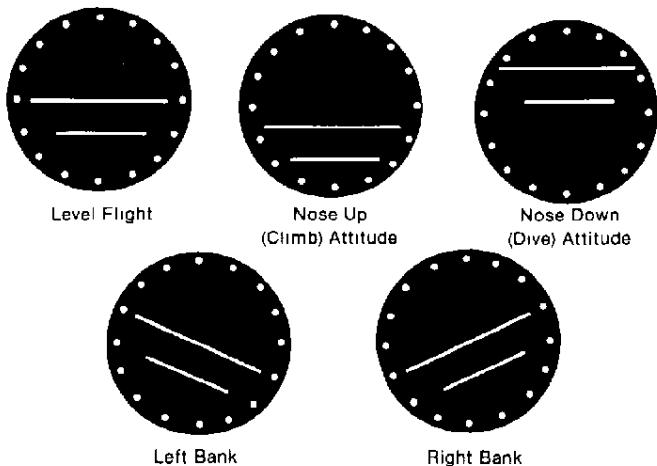
These two indicators are on the upper left corner of the instrument panel. The Airspeed indicator, labeled KTS, shows the aircraft's speed in knots. The numbers around the instrument indicate 0, 100, 200, and 300 knots. Your jet will crash due to overspeed if you exceed 375 knots.

The Power indicator, labeled P and located to the right of the Airspeed indicator, shows the amount of power developed by the engine. When the LEFT Joystick is fully forward, the vertical bar that indicates the amount of power developed, rises to the top. To decrease the power, pull back on the LEFT Joystick.

## The Control Column

Your **RIGHT** Joystick is the Control Column. Using it, you can move the ailerons, the elevator, and the rudder. Pulling back on the Control Column causes your jet to climb. Pushing forward, causes it to dive. Pushing left causes a left bank (or turn). Pushing right causes a right bank.

There are various instruments associated with the Control Column. The most important is the **Attitude Deviation Indicator**, located at the center of the screen (to the right of the Power indicator). The ADI shows the aircraft's angular deviation from a level position with respect to the horizon. The ADI is a "dual axis" instrument in that it displays both pitch and roll deviations.



As you can see from these ADI readings, when the aircraft maintains a straight and level flight, the artificial horizon line stays centered on the circular display. On a climb (nose up) attitude, the artificial

horizon line drops below the center of the display. Conversely, on a descend (nose down) attitude, the horizon line climbs over the center of the display.

When the aircraft is on a bank or turning attitude, the artificial horizon line tilts in the opposite direction of the turn. Additionally, the line may climb or descend depending on whether the aircraft is descending or climbing while banking.

## Keyboard Controls

Although the keyboard controls are not used constantly through the simulation, they're just as important as the Joystick controls. You can control the flaps, the landing gear and perform other functions with the keyboard controls.

## The Landing Gear

The landing gear is locked in place and retracted by pressing **(G)**. Retract the gear immediately after take-off. When you press **(G)** to retract the gear, the three blocks by the word GEAR in the Multi-function display disappear one by one and the flashing message GEAR appears at the bottom of the Multi-Function indicator. (The flashing message also appears to remind you to lock the gear in place when landing.) When you press **(G)** again to lock the landing gear in place, the three blocks reappear on the indicator.

### The Flaps

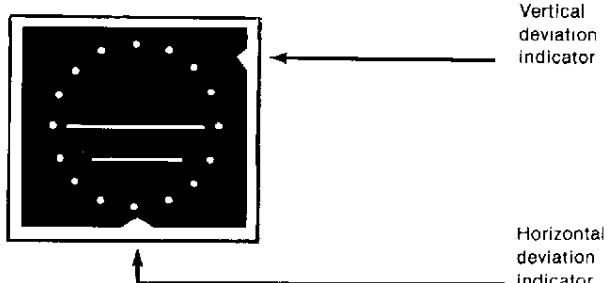
The flaps can be extended and withdrawn fully or partially. Everytime you press **E** (for Extend), the flaps are extended one fourth of the total extension. Pressing **E** four times results in full flap extension. Press **W** to withdraw the flaps one fourth. Press **W** four times to withdraw the flaps completely. The indicator associated with flap extension is to the right of the ADI, and it is labeled F1. A vertical bar raises or lowers as the flaps are either extended or withdrawn.

To increase lift, extend the flaps no more than half way. To increase drag and reduce airspeed, extend the flaps three-fourths or completely out.

### Other Indicators

In addition to the indicators directly associated with the controls, there are various others with which you need to be acquainted to gain complete control of the aircraft.

#### The Glidescope



The Glidescope is located outside the ADI and consists of the vertical and horizontal deviation indicators. This instrument is used during the landing approach. The Glidescope picks up a narrow radio beam transmission that is sent from the runway. Following the beam with the aid of the Glidescope results in an optimum descent condition. (Of course, other factors, such as the rate of descent and the ground speed, also have to be taken into account for successful landings.)

### The Altimeter

This display, labeled ALT and located at the extreme right of the top row of instruments, indicates altitude over sea level in thousands of feet. Inside the dial, a digital display shows altitudes between 0 and 999 feet. Once you are over 999 feet, the digital display blanks out and the needle indicates the altitude in thousands of feet.

### The Rate of Climb and Descent Indicator

This instrument, labeled ROC and located at the lower right hand corner of the screen, indicates the rate at which the aircraft ascends or descends in thousands of feet per minute. When the needle goes upward, the plane is in a nose-up climb attitude. When the needle goes down, the airplane is in a nose-down descend attitude. Optimum rate of ascent is reached at 1000 feet per minute. The optimum rate of descent (for making contact with a runway) occurs at about 750 feet per minute.

If you attempt to climb at a rate faster than 1000 feet per minute, you will soon find yourself stalling — loosing lift rapidly. Stalling occurs because the "angle of attack" is too steep. The angle of attack refers to the angle at which the wings meet the oncoming air. When the angle reaches a certain point, the air flow over the wings is no longer smooth. Instead, it bubbles and swirls in a disarrayed fashion. When this starts to happen, the flashing message STALLING appears on the Multi-Function Display.

To get out of the STALL condition, drop the nose of the airplane and/or increase the power.

#### **The Heading Indicator**

The Compass or Heading indicator, labeled HDG and located next to the Multi-Function Display, shows the aircraft's heading in degrees. 0 degrees indicates North; 90 degrees, East; 180, South; and 270, West.

#### **The Fuel Indicator**

The Fuel indicator, labeled F and located next to the Heading indicator, shows the amount of fuel in the tanks. When the vertical bar is at the top, you have a full tank. A full tank can keep your jet airborne for approximately 25½ minutes. (Actual time may vary depending on climb and acceleration maneuvers.)

#### **The Multi-Function Display**

The Multi-Function Display serves a variety of

purposes. For one, it shows Auto-Pilot heading and altitude settings. Also, it displays the cloud ceiling altitude and the crash messages (more on this later). Finally, it shows the current Flight Mode. Let's look at each of these in detail.

#### **The Auto-Pilot**

FLIGHTSIM I includes an advanced Auto-Pilot system that "flies" the jet to a heading and altitude set by you. The Auto-Pilot can be programmed while you're still on the ground or after you've taken off. You must still take off and land manually, however.

#### **Setting the Heading**

To set the heading, press **→** for one degree increments. Press **SHIFT** **→** for 10 degree increments. Conversely, press **←** for one degree decrements. Press **SHIFT** **←** for 10 degree decrements. Again, the Multi-Function Display shows the Heading you have selected next to the word HDG.

#### **Setting the Altitude**

To set the altitude, press **↑** for 100 feet increments. Press **SHIFT** **↑** for 1000 feet increments. Conversely, press **↓** to decrease altitude by 100 feet. Press **SHIFT** **↓** to decrease altitude by 1000 feet. The Multi-Function Display shows the altitude chosen next to the word ALT.

Having set both the altitude and heading, press **A** at any time to turn on the Auto-Pilot. Press **A**

again to turn off the Auto-Pilot. You may change the altitude and heading settings at any time, even while flying. Also, you may choose to fly manually to a certain point and then activate the Auto-Pilot.

### **The Cloud Ceiling**

When you fly through the clouds, your visibility is severely reduced. You must then make the most of your instruments to guide you through. When you initialize the simulation, the cloud ceiling is always set to 2000 feet. However, you may lower or raise the cloud ceiling to any altitude that you wish.

Set the cloud ceiling by pressing **C** (for Ceiling). The Multi-Function indicator then shows the current setting for the ceiling. Press **1** to raise the ceiling by 100. Press **SHIFT 1** to raise the ceiling by 1000 feet. Conversely, press **0** to lower the ceiling by 100 feet and **SHIFT 0** to lower it by 1000 feet. Press **C** again to erase the ceiling reading from the Multi-Function Display.

### **The CRASH Messages**

If you crash for any reason, the Multi-Function indicator shows the cause:

<b>CRASH!</b>	You have descended too fast. Ideally, vertical speed should not exceed 1000 feet per minute.
<b>VERT SPD</b>	

**CRASH!**  
OVER SPD

When the jet starts exceeding 375 knots, first the flashing message OVER SPEED appears on the Multi-Function display. If you do nothing to correct this (like reducing the speed and/or lifting the nose), the plane is torn apart in a few seconds. Then the crash message appears.

**CRASH!**  
ROLL ATTEMPT

One of the wings made contact with the runway as you touched down.

**CRASH!**  
GEAR

The landing gear was not locked in position to land.

You may restart the simulation after crashing by pressing **I** (for Initialize).

### **FLIGHTSIM I Modes**

FLIGHTSIM I operates under various modes to give you complete control of the simulation. You can activate and deactivate the different modes from the keyboard. Any mode that you choose appears on the Multi-Function indicator (bottom left corner of the screen). Here's a listing of the modes and their functions:

#### **The FREEZE Mode**

When you first turn on FLIGHTSIM, the FREEZE mode is in effect. You know this because the flashing

message FREEZE appears on the Multi-Function indicator. Press (F) to deactivate the FREEZE mode and start the simulation. Press it again to suspend it. You can activate the FREEZE mode at any time.

#### **The CRASH OVERRIDE Mode**

When the Crash Override (CRSH OVR) mode is active, it is impossible for you to crash. It's a good idea to use this mode on your first trial flights. You can activate and deactivate the CRASH OVERRIDE mode by pressing (O).

#### **The INITIALIZE Mode**

The INITIALIZE mode restarts the program. If you press (I) at any time, the jet is placed at the originating airport, with the simulation in the FREEZE mode. Use the INITIALIZE mode after a crash to start the simulation again.

#### **The TAKE-OFF Mode**

When you have landed at a nearby airport, and wish to continue towards another sight, press (T) (for TAKE-OFF). Your jet will be refueled automatically and placed at the beginning of the runway. Press (F) to deactivate FREEZE and proceed with your journey.

#### **The RECOVER Mode**

When, for any reason, you find that you have lost, and cannot regain control of the jet, press (R) (for RECOVER). A safety mechanism then takes over the jet controls and returns it to a level attitude. After the jet returns to a level attitude, you may again use the controls.

## Sample Session

At this point, you are familiar with basic flight principles and the various controls and indicators aboard your jet. Now, you are ready to tackle flight procedures such as taking off, climbing, banking, descending, and landing. You're encouraged to go on trial flights and attempt various maneuvers to develop a "feel" for the responsiveness of the jet to the controls.

When you think you're ready, you can plot a flight plan and "fly" to a neighboring airport. The aeronautical map shows the distance, exact headings, and locations of the airports and landmarks.

### Taking Off

Taking off is the most elementary skill that you must learn. Like other flight procedures, taking off is both a science and an art. It takes a steady hand behind the controls and a watchful eye on the instruments.

At this point, you are not going to fly to another airport. That requires a bit of planning. Instead, you'll simply take off, try a few maneuvers, fly back to the originating airport, and attempt to land safely.

Position yourself comfortably in front of the screen. If you're right-handed, use your right hand to maneuver the control column (the RIGHT joystick). If left-handed, then use your left hand.

Press **(F)** to deactivate the FREEZE mode and apply full thrust by pushing the LEFT Joystick forward. As the jet accelerates down the runway, make small corrections with the control column (the RIGHT joystick) to keep it centered on the runway.

When you reach take-off speed, anywhere between 150 to 200 knots, pull back gently on the control column. The ADI then shows the artificial horizon line dropping (because of your nose-up attitude).

The Altimeter shows your altitude in feet as you make your ascent into the skies.

To maintain the most efficient climb rate, keep the ROC (RATE OF CLIMB) at no more than 1000 feet per minute.

To reduce drag and develop maximum speed, retract the landing gear by pressing **(G)**.

Continue climbing and maintain a 0 degree heading (North) or as close to it as possible.

When you reach about 1000 feet, level the jet by pushing the control column forward until the artificial horizon line shows a level attitude and the ROC is 0.

As soon as the jet levels, the airspeed begins to increase. With full power applied, the jet will reach a cruising speed of 375 knots.

Bank right by pushing the control column towards the right. Observe your indicators, particularly the

ADI and the Heading indicators. The artificial horizon line tilts to the left. The heading indicator shows the new heading as you begin banking towards the East. Do the same towards the left.

If you lose control of the aircraft and cannot regain it, press **(R)** to recover a level attitude.

Experiment with your controls. Attempt various maneuvers. When you've gotten somewhat comfortable, make a 180 degree turn and head back towards the airport from which you took off. Since you took off in a 0 degree (or North) heading, to go back, the HDG indicator must show 180 degrees. If you have flown a long distance from your origin, the airport may not be immediately visible. Continue going South. Eventually, the airport (and some mountains located behind the airport) will appear on the screen. When you can make eye contact with the runway, drop to 800 feet. Then, activate the FREEZE mode. In the next section, you will attempt to land.

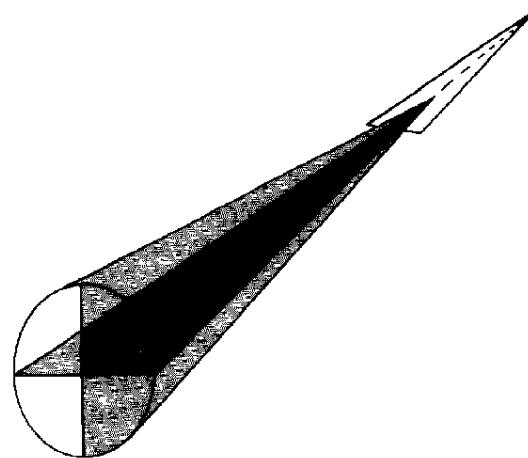
## Landing

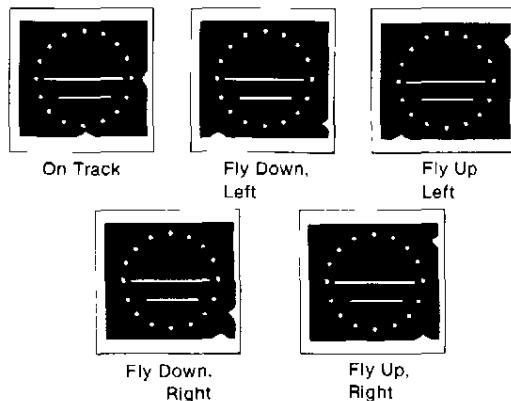
Landing is perhaps the most critical procedure in flying. To land successfully, your aircraft must be within certain performance parameters. First, your vertical speed (the speed at which the jet is descending) cannot be over 1000 feet per minute. Also, your airspeed must be within 120 to 200 knots. Finally, the jet must be level as it touches the runway.

To aid you in making a correct landing, each runway

of every airport signals the correct approach path by flashing an approach light. You must maneuver the jet so that you're flying directly into the approach light. Also, as you close in on the runway, you must pay close attention to the GLIDESCOPE. This instrument picks up the narrow radio beam emanating from a transmitter on the runway.

The GLIDESCOPE consists of a horizontal deviation indicator and a vertical deviation indicator. Both of these indicators track the beam from the runway and sway in the direction of the beam. Fly the jet in the same direction that the indicators move. See the illustration below:





Notice that when the jet is in the correct flight path to land, both indicators point to the center of the ADI.

You are now ready to begin landing. Deactivate the FREEZE condition by pressing **F**. As you move closer to the airport, reduce the airspeed to 250 knots or less. Also, extend the flaps half way out by pressing **E** twice. This is for a smooth glide into the airport. When the jet is 50 to 100 feet above the ground, extend the flaps fully to reduce the airspeed. For a safe touch down, maintain a level attitude. Use the fire button on the RIGHT joystick for braking when you finally touch down.

If you miss the runway but still manage to land, you may press **T** to place the jet in a take-off position at the start of the runway. Your fuel tank is automatically refilled. If you land at any airport other than at Airport 0, always press **T** to take off from that location. If you press **I** (for initialize) the entire simulation is restarted. That is, you begin from Airport 0, no matter where you've landed.

## Preparing a Flight Plan

No pilot ventures into the skies without first having worked out a "flight plan." The flight plan indicates the best route for reaching a particular destination. The pilot determines the flight plan by studying maps and aeronautical charts. Additionally, the pilot must determine the length of time and the amount of fuel that it takes to reach the destination. It may be necessary to stop at intermediate airports to refuel.

Your jet can fly about 162 miles (with 22.5 minutes of fuel). The actual range and time, however, may vary depending on the efficiency of your flight maneuvers (climbing, banking, and so on).

These are the basic steps for developing a flight plan (refer to the aeronautical map included with the package):

- Determine the distance to your destination. If the distance is larger than 160 miles, you will have to stop at an intermediate airport and refuel. Study the aeronautical map to see which airport(s) are in the vicinity of your destination.
- Determine the heading to the site you want to reach. If you are stopping at intermediate airports, determine the heading to these airports.

- Determine the amount of time it will take you to reach your destination. You can do this by dividing the distance (in miles) to your destination by 7.19 (cruising speed in miles per minute). Provide a 5 to 10 percent margin of error because of climbing, banking, and other maneuvers.







# FLIGHTSIM I Aeronautical Map

